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Research Article

The Receptive–Expressive Gap in Bilingual Children With and Without Primary Language Impairment

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Purpose: In this study, the authors examined the magnitude of the discrepancy between standardized measures of receptive and expressive semantic knowledge, known as a *receptive–expressive gap,* for bilingual children with and without primary language impairment (PLI).
Method: Spanish and English measures of semantic knowledge were administered to 37 Spanish–English bilingual 7- to 10-year old children with PLI and to 37 Spanish–English bilingual peers with typical development (TD). Parents and teachers completed questionnaires that yielded day-by-day and hour-by-hour information regarding children's exposure to and use of Spanish and English.
Results: Children with PLI had significantly larger discrepancies between receptive and expressive semantics standard scores than their bilingual peers with TD. The receptive–expressive gap for children with PLI was predicted by current English experience, whereas the best predictor for children with TD was cumulative English experience.
Conclusions: As a preliminary explanation, underspecified phonological representations due to bilingual children's divided language input as well as differences in their languages' phonological systems may result in a discrepancy between standardized measures of receptive and expressive semantic knowledge. This discrepancy is greater for bilingual children with PLI because of the additional difficulty these children have in processing phonetic information. Future research is required to understand these underlying processes.

A *receptive–expressive gap,* in which individuals' receptive standard scores are significantly higher than expressive standard scores, appears to be a common feature both of typical bilingual vocabulary development (Gibson, Oller, Jarmulowicz, & Ethington, 2012; Kan & Kohnert, 2005; Miccio, Tabors, Páez, Hammer, & Wagstaff, 2003; Muñoz & Marquardt, 2003; Oller & Eilers, 2002; Yan & Nicoladis, 2009) and primary language impairment (PLI; Dollaghan, 1987; Edwards & Lahey, 1996; Lahey & Edwards, 1996). Clinicians, therefore, may have difficulty determining whether the presence of a receptive–expressive gap in bilingual children is due to PLI or due to learning more than one language. Motivated by theoretical and clinical considerations, we compared the receptive–expressive gap in bilingual children with and without language impairment. Theories of PLI must be able to account for both the monolingual and bilingual circumstance, and the receptive–expressive gap in bilingual children with PLI provides a unique test of the predictions made by current theory. Clinically, an understanding of the processes underlying the receptive–expressive gap in bilingual children with and without PLI should inform practitioners' decision making when discriminating language differences from language disorders in bilingual children. As a first step toward understanding the gap between receptive and expressive language, we review the differing developmental trajectories and processing demands of these modalities.

Differences Between Receptive and Expressive Modalities

Receptive language and expressive language are highly correlated (Millett, Atwill, Blanchard, & Gorin, 2008) but dissociable (Bates, Dale, & Thal, 1995) modalities. Children's receptive vocabulary develops earlier than expressive vocabulary (Benedict, 1979), is larger than expressive vocabulary (Fenson, Dale, Reznick, & Bates, 1994; Nelson, Rescorla, Gruendel, & Benedict, 1978), and relates differently to cognition (Bates et al., 1995), language impairment

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(Chiat & Roy, 2008), and reading outcomes (Wise, Sevcik, Morris, Lovett, & Wolf, 2007) than does expressive vocabulary. Differences between the modalities are illustrated by the models that describe them (Gaskell & Marslen-Wilson, 1997; Indefrey & Levelt; 2004). Comprehension begins with the analysis of phonetic input and ultimately activates a concept, whereas production begins with a concept and ultimately produces phonetic output. Differences in receptive and expressive processing requirements likely contribute to differences in performance on receptive and expressive tasks. Both the *weaker links hypothesis* and the *inhibition hypothesis* are proposals that might explain the receptive–expressive gap in terms of these differing processing requirements.

Theories Explaining the Receptive–Expressive Gap in Bilingual Children With Typical Development

Because they must manage two languages in one mind, cognitive-linguistic processing of bilinguals differs from that of monolinguals. This difference results in both advantages and disadvantages for bilinguals. As reviewed by Bialystok, Craik, and Luk (2012), advantages are found for tasks that require executive control, including inhibition (Martin-Rhee & Bialystok, 2008), switching attention (Prior & MacWhinney, 2010), and working memory (Morales, Calvo, & Bialystok, 2012). Bialystok, Craik, Green, and Gollan (2009) argued that these advantages result from practice inhibiting the nontarget language (the language the individual does not want to speak in the moment), switching between languages, and the use of high levels of attentional control when managing two languages. In contrast, disadvantages for bilingual speakers include smaller receptive vocabularies (Bialystok, 2001), slower reaction times both for naming (Gollan, Montoya, Fennema-Notestine, & Morris, 2005) and identifying pictures (Ransdell & Fischler, 1987), and deficits in semantic fluency tasks (Gollan, Montoya, & Werner, 2002). A receptive–expressive gap, therefore, might be the result of bilingual disadvantages that reduce lexical access.

One possible explanation for bilingual disadvantages is the *weaker links hypothesis* (Gollan, Montoya, Cera, & Sandoval, 2008; Gollan et al., 2011), which was first proposed to explain the increased incidence of word retrieval failures in bilinguals compared to monolinguals (Gollan & Acenas, 2004; Gollan, Montoya, & Bonanni, 2005; Gollan & Silverberg, 2001). One of the most robust influences on lexical retrieval is the *word frequency effect,* in which more frequently used words are more easily accessed than less frequently used words (for review, see Ellis, 2002). The weaker links hypothesis proposes that bilinguals experience a global word frequency effect. Because they have less practice in either of their languages compared to their monolingual peers (Gollan et al., 2008), the words in both of their languages occur relatively less frequently for bilinguals. According to this hypothesis, the bilingual frequency effect is made manifest in the strength of the links between semantic and phonological representations. As words become more frequent (i.e., as bilinguals have more practice in a language), the links between semantic and phonological representations become stronger. Stronger links result in improved lexical access; weaker links result in reduced lexical access. The weaker links hypothesis, therefore, predicts that weak links are more likely to occur in the nondominant language than the dominant language (Emmorey, Petrich, & Gollan, 2013).

Recently, Gibson, Peña, and Bedore (2014) reported that for Spanish–English 5-year-old bilingual children, the receptive–expressive gap in English was largest for children with the most limited English experience. This gap decreased as English experience increased, consistent with the weaker links hypothesis. The authors extended the weaker links hypothesis and argued that not only do the links between semantic and phonological representations become stronger with practice in a language, but also the representations themselves become stronger. This was similar to a proposal made by Bybee (2010), who argued that memory for word forms is enhanced as production and perception of those forms becomes more frequent. Gibson et al. (2014) posited that a receptive–expressive gap in L2 occurred because underspecified phonological representations were sufficient for success on the less demanding receptive task but not the more demanding expressive task.

In addition to reduced practice in each language, bilinguals may experience interference from the nontarget language. Semantic concepts activate lexical items in both languages of bilingual speakers (Ivanova & Costa, 2008). For example, for a Spanish–English bilingual preparing to say *table* in English, both *table* and its Spanish equivalent, *mesa,* are activated (De Bot, 1992). How bilinguals manage interference from activated items in the nontarget language might also impact the receptive–expressive gap. Linck, Kroll, and Sunderman (2009) argued that there was global inhibition of the L1 in the context of L2 learning. Such inhibition might free cognitive resources to apply to learning the L2 and manage interference from the nontarget language. Gibson et al. (2012) found support for the *inhibition hypothesis*. Spanish (L1) standard receptive vocabulary scores exceeded standard expressive vocabulary scores by 21 points, but in English (L2), the difference was only 7 standard score points. This discrepancy was similar to the one found in a number of studies reporting expressive and receptive single-word vocabulary scores. Gibson et al. (2012) argued that in the face of L1 inhibition, individuals might be successful at the less demanding receptive task but not the more demanding expressive task, resulting in a larger receptive–expressive gap than that found in the L2.

Phonological Structure and the Receptive–Expressive Gap

In addition to the processes involved in managing two languages, the phonological complexity and phonemic inventory of the languages involved might also impact the receptive–expressive gap. Current theories of word learning (e.g., associationist approach, Smith & Yu, 2008; learning constraints approach, Waxman & Markow, 1995; social–pragmatist approach, Tomasello, 2003) assume that word learning begins with the extraction of phonological material from the speech stream, what Chomsky and Halle (1968) called "primary linguistic data." If one of the bilingual's sound systems is more complex than the other, sounds in the bilingual's two languages might develop at different rates, which might have downstream effects on the receptive–expressive gap. *Transfer,* where the phonology of one language influences the phonology of the other (Fabiano-Smith & Barlow, 2010), might further affect the development of phonology in bilinguals, which, too, might impact the receptive–expressive gap. In addition, phonological representations become stronger with increased frequency of use (Bybee, 2010). Because bilingual individuals seldom experience an even division of exposure to their two languages, one language likely will have stronger phonological representations than the other, enhancing lexical access in one language over the other.

For Spanish–English bilingual children, there is evidence that suggests that the phonologies of their two languages develop differently from one another. For example, the percentage of occurrence for consonant cluster reduction and final consonant deletion was greater in English than Spanish for 5-year-old Spanish–English bilingual children (Goldstein, Fabiano, & Washington, 2005). Fabiano-Smith and Goldstein (2010) found that productions in Spanish were less accurate for Spanish–English bilingual children than for monolingual Spanish-speaking children, but a similar difference was not present when comparing bilingual children's English productions to monolingual English-speaking children. Although Fabiano-Smith and Barlow (2010) found similar levels of complexity in the Spanish and English phonologies of Spanish–English bilingual 3-year-olds, they also identified examples of transfer, that is, Spanish sounds were found in English phonetic inventories and vice versa. The complex development of bilinguals' phonological systems might contribute to differences in lexical access in the two languages and thus influence the receptive–expressive gap.

There are qualitative differences between the phonologies of Spanish and English. English has 13 vowels and 24 consonants; Spanish has five vowels and 20 consonants (Hammond, 2001). Compared to Spanish, English has more consonant clusters, shorter words, and more closed forms than Spanish (Gorman & Gillam, 2003; Shriberg & Kent, 1982), as noted by Summers, Bohman, Gillam, Peña, and Bedore (2010). In contrast, Spanish has more multisyllabic words relative to English. A comparison of phonological development in Spanish (Goldstein & Iglesias, 1996) and English (Porter & Hodson, 2001) suggests that by later preschool age, Spanish-learning children have acquired relatively more of the phonemes of Spanish than English-learning children have in English at the same age. However, children continue to refine their production of speech sounds and ability to produce complex phonological forms through the early school years.

As detailed by Munson, Kurtz, and Windsor (2005), phonological knowledge engaged during lexical access is not limited to the knowledge of phonemes in isolation. The rules organizing acceptable combinations of sounds in a language, known as *phonotactic knowledge,* are also aspects of phonological knowledge and differ across languages. For example, words seldom end in a consonant in Spanish but frequently do in English (Hammond, 2001), and whereas words can begin with *str* in English, these consonants cannot begin Spanish words (Hualde, 2005).

Demographic Variables and the Receptive–Expressive Gap

In addition to the phonological structure of languages and the processes involved in managing them, the receptive–expressive gap might also be influenced by the language experiences of speakers. To our knowledge, only two studies have attempted to identify demographic variables that might predict the magnitude of the receptive–expressive gap. From a demographic questionnaire of their own design, Gibson et al. (2012) culled nine demographic variables associated with vocabulary development and used them as independent variables in a multiple-regression analysis with the receptive–expressive gap in Spanish (L1) as the dependent variable. Variables included birth country, attendance in an English-speaking preschool, age of first regular English exposure, mother's length of residency in the U.S., mother's English proficiency, mother's education level, number of adults in the home, number of children in the home, and birth order. Although the model predicted both Spanish and English vocabulary measures, it was statistically nonsignificant when predicting the discrepancy between receptive and expressive standard scores. These variables were used as proxies for English language exposure (e.g., children born in the U.S. likely had more English language exposure than children born in a Spanish-speaking country). Because children with both high and low levels of English exposure presented with a receptive–expressive gap in Spanish, the authors interpreted this to mean that exposure to a dominant L2, even when relatively limited, initiates a rapid transition to L2 rather than a gradual shift as suggested in many studies (see Kohnert, Bates, & Hernandez, 1999). Gibson et al. (2014), using a demographic questionnaire based on Gutiérrez-Clellen and Kreiter (2003), performed a similar analysis using age, age of first regular exposure to English, current experience in English, mother's education level, and gender as independent variables and the gap in English (L2) as the dependent variable. Age of first regular exposure to English was utilized as a measure of cumulative experience in English. Results showed that current experience in English, not cumulative experience, was the best predictor of the receptive–expressive gap in L2.

Theories Explaining the Receptive–Expressive Gap in Monolingual Children With PLI

The receptive–expressive gap is not unique to bilinguals. A significant proportion of monolingual children with PLI have receptive–expressive gaps. Children with PLI make up about 7% of the pediatric population (Tomblin et al., 1997). Although much of the literature on PLI has focused on grammatical difficulties, vocabulary deficits are also well documented (Rice, Buhr, & Nemeth, 1990). Among children with PLI, roughly one third to one half have difficulty with expressive but not receptive language (American Psychiatric Association, 2000). The participant descriptions in a number of studies of PLI (Evans, Saffran, & Robe-Torres, 2009; Gray, Plante, Vance, & Henrichsen, 1999; Lahey & Edwards, 1996) are consistent with this estimate. For example, Edwards and Lahey (1996) found that 17 of 66 children with PLI in their study had expressive language quotients 1.3 *SD* below receptive language quotients.

A variety of theories have been developed to explain the processes underlying PLI (for a review, see Leonard & Weber-Fox, 2012). These theories primarily focus on grammatical difficulties in PLI (Paradis, 2007). However, they also can be applied to the lexical difficulties these children exhibit (Bishop, 1997; Lahey & Edwards, 1999; McGregor & Windsor, 1996), including the receptive–expressive gap. Here, two hypotheses are reviewed: the *generalized slowing hypothesis* and the *surface hypothesis*. Both hypotheses focus on grammatical difficulties but have implications for vocabulary learning.

The generalized slowing hypothesis. In its original form, the generalized slowing hypothesis argued for a general slowing of cognitive processing with age (Birren, Woods, & Williams, 1980). This proposal has been extended to explain patterns of impairment for children with PLI. In a meta-analysis, Kail (1994) observed slower reaction times of monolingual children with typical development (TD) and PLI across 22 linguistic tasks (e.g., naming pictures) and nonlinguistic tasks (e.g., judging whether a word had appeared previously). Results of the meta-analysis showed a linear relationship between the reaction times of the two groups; children with PLI consistently took roughly 33% more time to perform the tasks than children with TD (Leonard & Deevy, 2004; Leonard & Weber-Fox, 2012). Slow processing speeds are correlated with decreased performance on language measures (Leonard et al., 2007; Miller, Kail, Leonard, & Tomblin, 2001). According to the generalized slowing hypothesis, although distinct processes underlie receptive and expressive language tasks, there is no reason to expect that the rate of slowing would be dissimilar between the two modalities.

Receptive language requires the analysis of phonetic input, identification of the phonological representation of the word, and matching of that representation to a concept, all of which takes less than 500 ms (Indefrey & Levelt, 2004) in typically developing adults. Production, on the other hand, requires that a concept be produced and attached to a semantic representation, which is then matched to a phonological form; this form is encoded phonetically and then produced by the articulators, a process that takes over 600 ms (Indefrey & Levelt, 2004; Levelt, Roelofs, & Meyer, 1999; Levelt et al., 1991). Although receptive and expressive language tasks recruit different processes with unique durations, the two modalities can be directly compared when behavioral test scores are standardized. It is expected that a group of children with a standardized score of 100 on a receptive language test would score about 100 on an expressive language test, despite expected differences in processing speed across modalities. Slower processing speeds should be reflected in overall lower standard scores, but the relationship between receptive standard scores and expressive standard scores should be similar such that a receptive–expressive gap would not be evident. Applied to bilinguals, the generalized slowing hypothesis would not predict any additional receptive–expressive gap for bilingual children with PLI beyond the gap that is experienced as part of typical bilingual development.

The surface hypothesis. The surface hypothesis, on the other hand, assumes that children with PLI have general processing capacity limitations and that a consequence is difficulty processing the phonetic characteristics of forms (surface forms) that are brief in duration and/or low in phonetic salience (Leonard, 1989; Leonard, Eyer, Bedore, & Grela, 1997; Leonard, McGregor, & Allen, 1992). In addition, children with PLI require more exposure to language than their peers to learn both words and grammatical forms. For example, Dollaghan (1987) found that children with PLI and children with TD performed similarly when they were given novel words and asked to identify their referents; but children with PLI performed significantly worse than children with TD when asked to name the referents. This pattern may have been related to the difficulty children with PLI have in forming strong phonological representations (Leonard & Deevy, 2004).

Difficulty processing phonetic information likely results in difficulty forming strong phonological representations. Sussman (1993) compared 4- and 5-year old children with and without PLI. In one task, children were asked to press a button if they heard a change in syllables (e.g., a change from *ba ba ba* to *da*). In another task, they were asked to identify a syllable (e.g., identify whether they heard *ba* or *da*). Both children with and without PLI successfully discriminated that a change in syllable had occurred, but children with PLI had much more difficulty actually identifying the syllable (*ba* vs. *da*) that had been produced. Sussman (1993) proposed that children with PLI had difficulty encoding already discriminated phonetic information into a phonological representation to be stored in memory. This difficulty appears related to phonetic targets relative to surrounding phonetic material. For example, sounds that make rapid transitions to the next sound, are short in duration relative to surrounding sounds, or are nonsalient (Leonard et al., 1997) are most likely to result in degraded phonological encoding.

A significant body of literature supports the notion that children with PLI have difficulty both with grammatical and lexical learning (Leonard, 1998), and this likely is related to difficulty processing phonetic information. For example, *s* in English third person singular *walks* is difficult for children with PLI to process because it has a rapid transition from the previous sound, short duration, and is not salient. Because there are a multitude of possible sound sequences in nongrammatical morphemes that also have these phonetic characteristics, it is reasonable to predict that children with difficulty processing phonetic information also will have difficulty learning words. Several studies have found that children with PLI have lower vocabulary scores and require more exposures to learn words compared to their peers with typical language development (Gray, 2003; Oetting, Rice, & Swank, 1995).

Because the phonological requirements of receptive language tasks are less demanding than expressive language tasks (Bates, 1993), the underspecified phonological representations of monolingual children with PLI might be sufficient to perform successfully a receptive language task but not an expressive language task (Gathercole, Hitch, Service, & Martin, 1997). Therefore, in contrast to the generalized slowing hypothesis, the surface hypothesis is consistent with the presence of a receptive–expressive gap for monolinguals with PLI. Extended to bilinguals, in concert with weak links observed in bilinguals, we extend the surface hypothesis to predict that the receptive–expressive gap associated with typical bilingual development will be greater for bilingual children with PLI than for bilingual children with TD.

Research Questions

Examination of bilingual children with and without PLI can help clinicians understand better the interaction and influence that language experience and ability have on receptive–expressive performance. In bilingual children with TD, the receptive–expressive gap seems to be the result of distributed input (e.g., Oller, Pearson, & Cobo-Lewis, 2007). It is unclear, however, how this is made manifest in the processes underlying the gap. As evident in the review above, when picture-pointing tasks are compared to picture-naming tasks, the gap appears in the L1 to a much greater degree than in the L2. This has been explained by arguing that the L1 is inhibited in the context of L2 learning. However, when broader semantic tasks, such as producing/identifying categories, functions, and definitions are used as measures, the gap appears to a much greater degree in the L2 than in the L1. This has been explained by a frequency effect hypothesis (Gibson et al., 2014). What is unclear is if the magnitude of the receptive–expressive gap observed in bilingual children with TD will also be observed in bilingual children with PLI.

Based on the above review, we asked the following questions:

1. Is the receptive–expressive gap present in either English or Spanish for bilingual children with or without PLI?
2. Is there a difference in the magnitude of the receptive–expressive gap of bilingual children with PLI and bilingual children with TD?
3. What factors are related to the receptive–expressive gap of bilingual children with PLI and bilingual children with TD? Are the factors different for each?

Predictions

Processing accounts like the generalized slowing hypothesis and the surface hypothesis likely will contribute to understanding of the receptive–expressive gap in bilingual populations. In children with PLI, the receptive–expressive gap may be attributed to children's information processing difficulties (Leonard, et al., 2007) leading them to require relatively more input to acquire language skills comparable to those of their peers with typically developing language skills (Leonard & Deevey, 2004; Schwartz, 2009). It is not clear, however, if these processing difficulties are due to generalized slowing of all cognitive processes or due to more specific deficits processing phonetic information as proposed in the surface hypothesis. If the magnitude of the receptive–expressive gap in bilingual children with PLI is larger than that for bilingual children with TD, it would suggest that children had difficulty processing phonetic information, consistent with the surface hypothesis. It should be noted that this would not rule out the presence of generalized slowing in conjunction with phonetic processing difficulties. However, if the magnitude of the gap is similar for bilingual children with and without PLI, it is likely that phonetic processing difficulties did not additionally contribute to the receptive–expressive gap. Instead, if lower overall scores are present, they likely would be due to generalized cognitive slowing, consistent with the generalized slowing hypothesis.

Method

Participants

Participants in this study originally were reported on by Sheng, Peña, Bedore, and Fiestas (2012). Participants were drawn from a group of 186 children with complete data who participated in a study of Spanish–English bilingual semantic and syntactic development. They included 74 Spanish–English bilingual children ages 7;0 to 9;11 (years; months). Thirty-seven children with PLI were matched by age and language experience with 37 children with TD. Another 61 children were drawn from the database to form two comparison groups: English dominant and Spanish dominant. These comparison group samples were used to develop testing norms for the analysis (see below). All children were of Hispanic ethnicity and attended school in the metropolitan areas of Austin, Texas, and Denver, Colorado. Children who spoke both Spanish and English were invited to participate in the study. To be included, children could not have neurological impairments, hearing impairments, or autism spectrum disorders.

Determination of participant language status. In absence of a gold standard for identification of language impairment in bilinguals, we used converging evidence to determine language ability status. Children were categorized as having PLI if they met at least three of the following four factors. First, parents and teachers rated children's Spanish and English proficiency on a scale of 1 (*low proficiency*) to 5 (*high proficiency*) at the levels of comprehension, speech, sentence length, grammar, and vocabulary (adapted from Gutiérrez-Clellen & Kreiter, 2003; Restrepo, 1998; see Table 1 for proficiency ratings). The scores for each level were summed and averaged, and the higher language (Spanish or English) score was entered into the analysis. Scores for children whose ratings were at least 1 *SD* below those of all other participants were treated as possibly indicating PLI. In addition, parents and teachers were asked if they had concerns about the child's speech and language. These concerns were reviewed and treated as valid (e.g., "forgets words in both languages") or invalid (e.g., "doesn't use Spanish much so his Spanish isn't very good") by a speech-language pathologist (SLP). Only valid concerns were treated as possibly indicating PLI. Whether a parent reported a valid concern or provided low proficiency ratings, each was treated as meeting one of the criteria for PLI. Second, testers reported concerns regarding children's language performance; reports of children who demonstrated difficulty at the time of testing were treated as possibly indicating PLI. Third, children provided narrative samples in English and Spanish (based on Gillam & Pearson, 2004). Percent grammatical utterances was calculated for each language. If percent grammatical utterances fell below 80% in the better language (i.e., the language with the highest reported proficiency rating), this was treated as possibly indicating PLI (consistent with Gutiérrez-Clellen, Restrepo, Bedore, Peña, & Anderson, 2000). Finally, if children were already receiving speech-language services (and their Individualized Education Program indicated language goals) in school, this was considered an indicator of PLI.

Of the 186 children tested, 37 were categorized as having PLI. Of these, 35 were already receiving SLP services and met at least the first two criteria. An additional two students were not receiving SLP services but were included in the PLI group because parents reported their children's language proficiency in both languages to be more than 1 *SD* below the average of the PLI group, both parents and teachers reported concerns, and fewer than 80% of their utterances during narrative discourse were grammatical. For inclusion in the TD group, children could have up to one indicator of PLI. Of the TD group, 35 were not receiving SLP services and there was no parent/teacher concern.

Table 1. Parent and teacher report of language proficiency.

Language proficiency	PLI		TD	
	M	*SD*	*M*	*SD*
Parent rating				
English	2.93	0.94	3.92	0.67
Spanish	3.94	0.71	4.60	0.47
Teacher rating				
English	2.69	0.83	3.81	0.92
Spanish	3.32	0.66	4.65	0.68

Note. Ratings based on scale from 1 (*low proficiency*) to 5 (*high proficiency*). PLI = primary language impairment; TD = typical development.

Two of the children in the TD group were identified by the school district as having PLI, but there was no parent/teacher concern and their percentage of grammatical utterances was greater than 80%.

Matching criteria. Children with PLI were matched to children with TD on age (PLI = 8;4; TD = 8;4), language dominance based on parent/teacher questionnaires (PLI = 43% English use; TD = 43% English use), and age of regular English exposure (PLI = 4.08 mean year of first English exposure; TD = 3.95 mean year of first English exposure). Although not a matching criteria, socioeconomic status (SES) was also similar for the two groups (PLI = 20.91; TD = 21.32; Hollingshead, 1975). A series of *t* tests showed that the two groups did not differ across these criteria (see Sheng et al., 2012).

Materials

Parent and teacher interviews. A parent interview was conducted by phone and teacher interviews were done in person at schools using procedures based on Gutiérrez-Clellen and Kreiter (2003). This questionnaire focused on child exposure to Spanish and English, and parent ratings of language performance. We also obtained information on families' SES. For information on language exposure, parents reported the language(s) the child was exposed to each year from birth to current age. We used this information to determine the age at which the child was first regularly exposed to English. Parents also reported on language input (what the child heard) and output (what the child said) in the home on an hour-by-hour basis for both typical weekdays and weekends. Specifically, parents reported the activity that was likely to be occurring at that hour on that day and the likely participants, as well as the language input and output. A weighted average of this data provided a measure of current language experience at home. Teachers completed a similar questionnaire to provide a measure of current language experience at school. Parent and teacher data were combined to account for both time at home and time at school to provide a measure of current language experience across contexts.

Information regarding SES was based on parents with whom children resided. To provide a measure of parental educational attainment and occupational status, we administered the questionnaire developed by Hollingshead (1975). Education was scored from 0 to 7 (*no formal education* to *graduate degree,* respectively), whereas occupational status was scored from 0 to 9 (*unemployed* to *professional/executive,* respectively). This data was used to develop a family SES score. Consistent with Hollingshead, we gave priority to the parental occupation score by multiplying it by 5 while multiplying the educational attainment score by 3 and adding the products. Scores for mother and father were averaged to obtain a single score for family SES. We included only the scores for parents with whom children resided. The mode for mother occupation was 0 (stay-at-home mom) and mother education was 4 (high school education). The mode for father occupation was 2 (primarily restaurant and construction work were reported) and father education was 4 (high school education).

BESA–ME. Children's semantic knowledge was evaluated by their performance on the Bilingual English Spanish Assessment—Middle Extension (BESA–ME; Peña, Bedore, Gutiérrez-Clellen, Iglesias, & Goldstein, 2010; see, Peña, Bedore, & Fiestas, 2013 for a review). The BESA–ME is an experimental version of the Bilingual English Spanish Assessment (BESA; Peña, Gutiérrez-Clellen, Iglesias, Goldstein, & Bedore, 2014), extending the age range from 7;0 to 9;11. The experimental test includes both morphosyntactic and semantic questions targeting children ages 7;0 to 9;11. Because the former does not fall within the purview of the current study, only semantic test items will be reviewed here.

The BESA–ME consists of receptive and expressive semantic tasks in English and Spanish. Items in each language version are translation equivalents. Seven tasks were used to tap different areas of semantic knowledge. Tasks include identification (receptive language) and production (expressive language) of the following: categories (e.g., "Tell me all the zoo animals you can think of"), functions (e.g., "What do you do with a mop?"), characteristic properties (e.g., "Tell me about this ball"), associations (e.g., "If I say dinner, you say ____"), definitions (e.g., "Tell me the definition of book"), similarities and differences (e.g., "How are these three things similar?"), and analogies (e.g., "Chair goes with sit as oven goes with ____").

The item set originally consisted of 125 questions (56 receptive and 69 expressive) in each language. One receptive and two expressive questions yielded ambiguous, unscorable results and were thus excluded from analysis. This left 122 items (55 receptive and 67 expressive) in each language for analysis. Cronbach's alpha was calculated for each language as a measure of internal consistency. Alphas of .971 and .969 for Spanish and English respectively demonstrated high internal consistency for these versions of the measure.

BESA–ME norming procedures. Each of the 186 children from the original sample were administered the BESA–ME. Original scoring of this test implemented conceptual scoring in which correct answers from either language were accepted. Because we were interested in target-language lexical access (accessing words in the language the individual wishes to speak), we rescored these tests such that only correct answers provided in the target language were accepted. Fidelity for the rescoring was 98.7%. There were no monolingual speakers among the 186 participants. Therefore, we normed on the basis of children from the 186 original participants whose language experience in the target language reached at least 60%. This was consistent with previous studies that have shown that the performance of bilinguals in their dominant language is similar to that of monolinguals (Peña, Gillam, Bedore, & Bohman, 2011). Children were included in the English comparison group if they were English dominant and had TD. The English comparison group included 30 children; 16 of the children in the English comparison group were included in the experimental analysis. The Spanish comparison group, with 54 children, was selected on the same criteria in Spanish and included seven children from the experimental group.

In order to make comparisons between language modalities and to control for language experience, we standardized the BESA–ME scores based on the comparison groups' scores. First, we calculated the receptive and expressive percent correct scores for each child. We then calculated the average percent correct scores and *SD*s in each language on each task type for both comparison groups and used these scores in the standardization procedure (Allen & Yen, 1979). The *M*s and *SD*s of the two comparison groups were used to develop Z-scores for all participants, and these were then converted into standard scores where the *M* was 100 and the *SD* was 15.

Procedure

Children were tested in a quiet place in their school. Spanish and English tests were administered during separate sessions, typically within 2 weeks of each other. The order of testing was random. Testers were certified SLPs, trained research assistants with previous testing experience, or students enrolled in a communication sciences and disorders program, who were supervised by MA- or PhD-level SLPs. Responses were written down verbatim in the language of response.

Statistical Analyses

In order to identify the presence of the receptive–expressive gap, determine differences between the gaps of bilingual children with and without PLI, and determine the role of task type (our first three research questions), we performed a 2 (Test Language) × 2 (Modality) × 7 (Task Type) repeated-measures analysis of variance (ANOVA) with language ability (either TD or PLI) as the between-subjects variable. We report partial eta-squared (η_p^2) as the effect-size measure with the ANOVA results because it excludes variance produced by other independent variables and includes only variance from the target variable (Pierce, Block, & Aguinis, 2004). No guidelines exist to interpret the eta-squared effect sizes, so we adopted guidelines based on correlation analysis due to the strong relationship between the general linear model and correlation analysis. The interpretation of effect sizes was as follows: 00–.10 = negligible, .10–.25 = small, .25–.50 = moderate, .50–.80 = large, .80–1.00 = very large. These analyses were followed by *t* tests to identify differences between groups on individual variables. A Bonferroni correction was used to control for multiple comparisons.

In order to identify which variables best predict the presence of the receptive–expressive gap, we performed multiple-regression analyses using five variables highly related to language development and which we performed in Gibson et al. (2014). These variables included age, current English language experience (the combination of language experience in both the home and school contexts), the age at which the child was first regularly exposed to English, mother's education, and sex. Each variable was drawn from the responses to the parent questionnaire.

Results

The Presence of the Receptive–Expressive Gap

All scores reported in the Results section are based on standardized scores with a mean of 100 and *SD* of 15 (see Table 2 for descriptive statistics). There was a main effect for modality, $F(1, 72) = 46.96$ $p < .01$, $\eta_p^2 = .40$. Participants scored higher on receptive tasks ($M = 81.76$) than expressive tasks ($M = 73.08$). There was also a main effect for test language, $F(1, 72) = 97.80$, $p < .001$, with a large effect size, $\eta_p^2 = .58$. The participants in this study scored higher in overall Spanish (average of receptive and expressive Spanish testing, $M = 83.84$) than English (average of receptive and expressive English testing, $M = 65.50$), $t(73) = 9.23$, $p < .001$. The interaction between modality and test language was significant, $F(1, 72) = 19.83$, $p < .001$, $\eta_p^2 = .22$. There was a significant receptive–expressive gap in English: receptive, $M = 76.06$, expressive, $M = 61.87$, $t(73) = 5.99$, $p < .001$, but no receptive–expressive gap in Spanish: receptive, $M = 87.46$, expressive, $M = 84.28$, $t(73) = 1.51$, $p = .14$.

Differences in the Receptive–Expressive Gap by Language Ability

There was a main effect for language ability (bilingual children with PLI vs. bilingual children with TD), $F(1, 72) = 57.79$, $p < .01$, $\eta_p^2 = .45$, with the overall score for children with PLI, $M = 56.12$, considerably lower than the overall score for children with TD, $M = 93.00$, $t(72) = 7.29$, $p < .001$. Further, modality interacted with language ability, $F(1, 72) = 10.49$, $\eta_p^2 = .13$, indicating that the magnitude of the receptive–expressive gap differed between children with and without PLI. Post hoc Scheffe's test of multiple comparisons found the 12 standard score point gap for children with PLI was significantly greater than the 5 standard score point gap for children with TD.

Best Predictors of the Receptive–Expressive Gap

Using multiple-regression analysis, we used five demographic variables to predict the presence of the receptive–expressive gap in English for both TD status groups (see Tables 3 and 4). The model was statistically significant for children with PLI, $F(5, 31) = 4.33$, $p = .004$, and for children with TD, $F(5, 31) = 2.99$, $p = .03$. For children with PLI, this model explained 41.1% of the variance in the receptive–expressive gap; current English experience explained 27.7% of the variance and was the only variable that uniquely contributed to variance explained (beta =.55, $p = .001$). For children with TD, the model explained 32.5% of the variance and was driven by the age at which children were first regularly exposed to English, explaining 19.2% of the variance, and the only variable uniquely contributing to variance explained (beta = .40, $p = .02$).

Table 3. Multiple-regression analysis predicting receptive–expressive gap for bilingual children with TD.

Variable	$R^2\Delta$	Beta
Age	.100	–.333
Age of first English experience	.192	.395*
Current English experience	.031	–.175
Mother's education	.003	–.056
Gender	.000	–.007

*$p < .05$.

Table 4. Multiple-regression analysis predicting receptive–expressive gap for bilingual children with PLI.

Variable	$R^2\Delta$	Beta
Age	.005	.084
Age of first English experience	.078	.156
Current English experience	.277**	–.550**
Mother's education	.045	.220
Gender	.006	–.078

**$p < .01$.

Discussion

We asked if there was a difference in the receptive–expressive gaps of bilingual children with and without PLI and if the factors related to this gap were different for each group. We identified the discrepancies between receptive and expressive standard scores within each language and for each group and followed this with an analysis of variables that were likely to predict the presence of the receptive–expressive gap. In general, the receptive–expressive gap of bilingual children with PLI was larger than that of bilingual children with TD. Although language experience played the major role in predicting the presence of the gap in both groups, the type of language experience that was important

Table 2. *M* and (*SD*) for standardized semantics tests in Spanish and English.

	Spanish		English	
Language status	Receptive	Expressive	Receptive	Expressive
TD	100.85 (17.33)	100.29 (16.42)	92.36 (17.82)	82.86 (27.64)
PLI	74.07 (23.62)	68.26 (22.48)	59.76 (21.98)	40.88 (32.72)

was different for each group, even though the two groups had comparable language experience.

Presence of the Receptive–Expressive Gap: English (L2) But Not Spanish (L1)

Bilingual children did not have a receptive–expressive gap in Spanish but did present with a receptive–expressive gap in English. These results extend findings by Gibson et al. (2014), who reported a receptive–expressive gap for Spanish–English bilingual children in English (L2) but not Spanish (L1). In that study, we argued for an extension of the weaker links hypothesis (Gollan et al., 2008), which posits that bilingual individuals' performance on expressive language tasks improves because the links between semantic and phonological representations become stronger. As these links intensify, lexical access improves, and this is reflected in enhanced performance on expressive language tasks (Bybee, 2010). In our extension of the weaker links hypothesis, we asserted that not only are the links between semantic and phonological representations strengthened by experience in the target language but the representations themselves are strengthened through language experience. On average, children in this study were not introduced to English on a regular basis until age 4 years. Because of their later introduction to English, participants had 4 more years of practice in Spanish compared to English. This likely increased the strength of phonological representations in Spanish and might explain why the receptive–expressive gap did not appear in Spanish.

Patterns of the Receptive–Expressive Gap: Magnitude Greater for Children With PLI

Similar to bilingual children with TD, the bilingual children with PLI in this study had a significant receptive–expressive gap in English but not Spanish. However, not only were overall scores lower for the PLI group than the TD group, but the magnitude of the receptive–expressive gap in English was notably larger for the PLI group than the corresponding gap for the TD group. This suggests an additive effect resulting from the processes underlying PLI, such as described in the generalized slowing and the surface hypotheses. However, according to the generalized slowing hypothesis all cognitive processes are slowed at a similar rate for individuals with PLI, whereas according to the surface hypothesis individuals with PLI have difficulty processing phonetic information. Both hypotheses, therefore, predict overall lower scores for the PLI group than the TD group, but only the surface hypothesis predicts a larger gap for the PLI group.

Although the focus of the surface hypothesis has been on morphosyntax, the hypothesis can be applied to other phonologically demanding material. Recall that the surface hypothesis predicts that children with PLI will have difficulty processing sounds of brief duration and low perceptual salience. Support for the surface hypothesis can be found across several languages (for Italian, see Leonard & Bortolini, 1998; for English, see Leonard et al., 1997; for Spanish, see Bedore & Leonard, 2001), however, cross-linguistic comparisons demonstrate that English-speaking children with language impairment produce many more errors than their peers with language impairment who speak other languages (Leonard, 1998). Another reason that English learning may have difficulties that extend beyond grammatical markers is that there are other ways in which the phonetic processing of English might be challenging. For example, in order to discriminate between the high number of vowels in English, typically developing speakers of English are more sensitive to subtle phonetic changes in vowels than are speakers of languages with fewer vowels (Liu, Tao, Wang, & Dong, 2012). Typically developing English speakers also have difficulty identifying vowels from other languages because of the large number of possible categories into which they might fit (Frenck-Mestre, Meunier, Espesser, Daffner, & Holcomb, 2005). For children with PLI who have difficulty processing phonetic information, L2 presents with a greater processing challenge. This may help explain the greater vocabulary deficits because these difficulties may interfere with children's ability to form and retain phonological representations of new words.

We posit that bilingual children with PLI are subject to the same influences of language experience and language structure as are bilingual children with TD, but they are additionally subject to the processes underlying PLI. As a consequence of divided language experience, bilingual children with PLI present with phonological representations that are underspecified compared to their monolingual peers. For bilingual children with PLI, these underspecified representations are further degraded by their difficulty processing phonetic information. The result is a receptive–expressive gap for bilingual children with PLI that is much larger than that of their TD counterparts. The structural differences between the phonologies of English and Spanish increase the likelihood that the gap will be greater in English than in Spanish because children are not as familiar with the structure of English as they are with the structure of Spanish. This is consistent with studies that show that monolingual children with PLI have more difficulty than their peers with TD when mapping unfamiliar phonological forms to meanings (Alt, 2011; Alt & Plante, 2006). The current study did not examine directly the phonological complexity of the test items or children's responses. Future studies should investigate these variables to determine the role of differential phonological complexity on the receptive–expressive gap.

Best Predictors of the Receptive–Expressive: Gap Differed for TD Status Groups

For bilingual children with TD, the age of their first English experience was the primary factor impacting the magnitude of the receptive–expressive gap, explaining 19% of the variance in the gap. This contrasts with our previous findings on younger participants, ages 5 to 7 years, for whom current English experience uniquely predicted the magnitude of the gap but age of first exposure to English did not (Gibson et al., 2014). In the current study, in which participants were ages 7 to 9;11 years, it appears that for the bilingual TD group, cumulative experience, as measured by age of first English experience, is most important. It is likely that this is related to a developmental trend that can be identified in previous research. Studies have demonstrated that the language skills of L2 learners improve as they gain experience with the target language (Bedore et al., 2012; Hammer, Lawrence, & Miccio, 2007), and their linguistic representations grow durable and less susceptible to change as language experience increases (Flege, 2003). As learners gain experience, they may be able to draw more consistently from established patterns of connections because their phonological representations are better represented (Gollan et al., 2008).

As reported above, there appears to be a developmental trend whereby bilingual children with TD rely less and less on current English experience as they grow older and their language systems become well established. The current study indicates that the 7–9;11-year-old bilingual children with PLI have receptive–expressive gaps comparable in size to the 5–7-year-old bilingual children with TD in our previous study who were just starting to learn English (Gibson et al., 2014). The results of the regression analysis identify comparable predictors. These children appear to be sensitive to current use in a way that their age-matched peers are not. Given the pattern of performance of younger and older typically developing children, we expect that bilingual children with PLI take longer than bilingual children with TD for their language systems to become well established.

Clinical Importance

The presence of the receptive–expressive gap further complicates clinicians' attempts to tease apart language disorder from language difference in bilingual children. Further research is needed to understand this gap, develop norms, and create strategies to interpret it. First, clinicians should anticipate a receptive–expressive gap, even for bilingual children with TD. However, the presence of the gap alone likely is not an indicator of language disorder. Children with PLI in this study had larger receptive–expressive gaps and overall lower scores than their TD peers. In order for the receptive–expressive gap to be an indicator of language impairment, we propose that both a large receptive–expressive gap (e.g., a discrepancy of 1.5 *SD*) and lower overall scores should be evident. Second, the results of the current study show that bilingual children with PLI are more sensitive to day-to-day changes in language exposure than are their TD peers. Clinicians might take time to activate the target language via conversation or play, especially before assessment but also before treatment. This might maximize bilingual children's performance. Other measures of vocabulary not administered in the current study might provide greater understanding of the receptive–expressive gap. The current study did not examine directly the phonological complexity of the test items or children's responses. Future studies should investigate these variables to determine the role of differential phonological complexity on the receptive–expressive gap.

Limitations

In the current study, standard scores were calculated for children who had 60% or more of language experience in the target language. Presumably, the use of true monolinguals as the norming group would yield slightly different results, with comparably greater receptive–expressive gaps in the bilinguals. Yet, bilinguals who have this level of dominance performed similarly to monolinguals in previous studies (Peña et al., 2011). In addition, other processes might be involved in the receptive–expressive gap; for example, children with PLI have been found to have difficulty maintaining phonological representations in short-term memory (Gathercole & Baddeley, 1993), which might also contribute to difficulty in developing phonological representations. Finally, although we focused on phonological representations, we cannot rule out the possibility that other levels of representation might also be involved. Underspecified semantic representations might result in many of the same phenomena seen here. Future studies should attempt to tease apart the level of representation associated with the receptive–expressive gap.

Conclusions

Although bilingual children with TD have a discrepancy between receptive and expressive language performance even after controlling for inherent differences in difficulty between the two modalities, bilingual children with language impairment have an even larger gap. This results perhaps because bilingual children with PLI create underspecified phonological representations due both to divided language experience associated with being bilingual and to difficulty processing phonetic information, which is associated with having PLI. Such a result is consistent with the surface hypothesis, which asserts that individuals with PLI have difficulty processing phonetic information. Furthermore, it appears that as bilingual children with TD experience more language as they age, their language systems become well established and less susceptible to day-to-day changes in language experience; however, bilingual peers with PLI continue to be sensitive to everyday changes in language experience, suggesting that their language systems are not yet well established.

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